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IS 4213 (1991): Engineering metrology – Vernier depth gauges up to 300 mm [PGD 25: Engineering Metrology]

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IS : 4213 - 1991

(Reaffirmed 1995)

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REAFFIRMED

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(पहला पुनरीक्षण)

Indian Standard

ENGINEERING METROLOGY – VERNIER
DEPTH GAUGES UP TO 300 mm —
SPECIFICATION

(First Revision)

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

Engineering Metrology Sectional Committee, LMD 05

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Engineering Metrology Sectional Committee had been approved by the Light Mechanical Engineering Division Council.

This standard was first published in 1967. This first revision has been brought out in the light of prevailing technical practices in the country.

In formulation of this standard, assistance has been derived from ISO/DP 9032 : 1985 ‘Length measuring instruments—Vernier depth gauges reading to 0'02 mm’ issued by the International Organization for Standardization (ISO), and DIN 862 : 1988 ‘Vernier callipers : requirements, testing’, issued by Deutsches Institut für Normung, Germany.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values revised’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

**AMENDMENT NO. 1 APRIL 2002
TO
IS 4213 : 1991 ENGINEERING METROLOGY —
VERNIER DEPTH GAUGES UP TO 300 mm —
SPECIFICATION**

(First Revision)

(*Page 3, clause 8.2.2, line 4*) — Substitute '8.1' for '7.1'.

(BP 25)

Reprography Unit, BIS, New Delhi, India

Indian Standard

ENGINEERING METROLOGY — VERNIER DEPTH GAUGES UP TO 300 mm — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard covers dimensional, functional and quality requirement of vernier depth gauges with a least count of 0·02 mm and a maximum measuring range of 300 mm.

NOTE — These vernier depth gauges are also commonly known as 1/50 mm vernier depth gauges.

1.2 Methods for testing the accuracy of the instrument are given in Annex A for general information only.

2 REFERENCES

The Indian Standard IS 2984 : 1981 Slip gauges (*first revision*) is a necessary adjunct to this standard.

3 NOMENCLATURE AND DEFINITIONS

3.1 For the purpose of this standard, the nomenclature shown in Fig. 1 shall apply.

NOTE — The vernier depth gauges may also be provided with fine adjustment mechanism.

3.2 Measuring Range

The maximum distance separating the measuring face of the beam and the reference face.

3.3 Error of Measurement

The algebraic difference between the measured size and true size.

3.4 Measuring Uncertainty

It is the error margin corresponding to the inherent errors of measurement of vernier depth gauges. It is defined as being equal to ± 2 that is for a normal distribution of the readings on the instrument, about 95 percent of readings will not deviate from the mean size (true value) by more than twice the standard deviations.

4 TYPES

The various types of vernier depth gauges can be identified according to the geometrical appearance of the graduated beam measuring end.

4.1 The most common types are the following (*see Fig. 2*):

Type 1 Rectangular Flat end

Type 2 Relieved End.

4.2 Optional Parts and Fittings

If agreed to between the purchaser and the supplier, following additional types of measuring ends may be supplied:

- a) With an interchangeable pointer (*see Fig. 3A*), and
- b) With a fixed or rotating heel (*see Fig. 3B*).

5 DIMENSIONS (*see Fig. 1*)

Depth Measuring Range, mm	Minimum Length of Base, mm
100	63
150	100
200	100
300	150

6 MATERIAL AND HARDNESS

6.1 Material

The main parts of vernier depth gauges such as beam and slider shall be made from either plain carbon steel or stainless steel, with a coefficient of thermal expansion in the temperature range 10 to 30°C within the limits ($11\cdot5 \pm 1\cdot0 \times 10^{-6} \times K^{-1}$).

6.2 Hardness

The hardness shall be as given below:

- a) Beam, not less than 350 HV, and
- b) Measuring faces and reference face:
Carbon steel, not less than 700 HV, and
Stainless steel, not less than 550 HV.

7 GENERAL REQUIREMENTS

7.1 Beam

The beam shall be long enough for the slider assembly not to overhang while measuring at the end of the measuring range. A locking screw may be provided at the end of the beam to avoid the slider assembly coming out of the vernier depth gauge.

7.2 Slider

A suitable clamp shall be provided on the slider so that when clamped effectively to the beam reading is not altered.

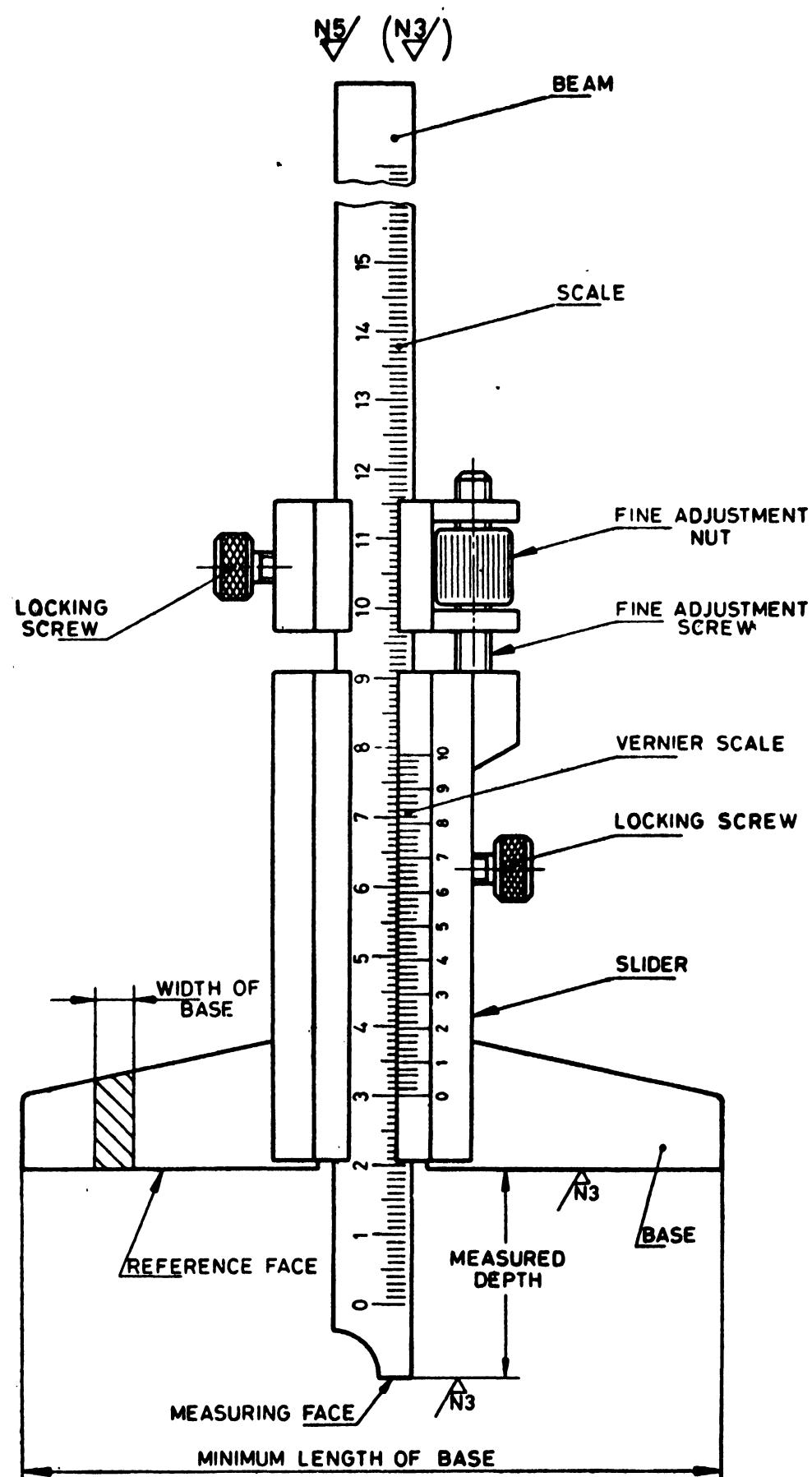


FIG. 1 NOMENCLATURE OF VERNIER DEPTH GAUGE

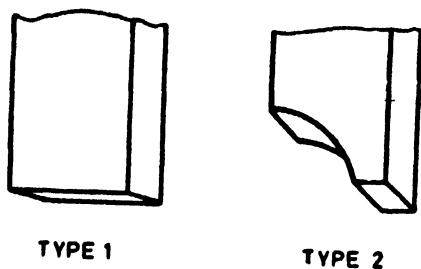


FIG. 2 TYPES OF VERNIER DEPTH GAUGE

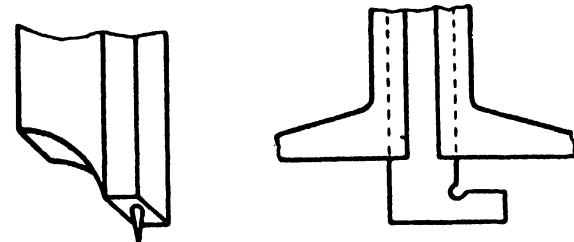
A) WITH INTERCHANGEABLE
POINTER B) WITH FIXED OR
ROTATING HEEL

FIG. 3 OTHER TYPES OF MEASURING ENDS

7.3 Scales

7.3.1 The beam shall be graduated in millimetres. The numbering will indicate either millimetres or centimetres. The length of the graduated part of the beam shall be at least equal to the measuring range of the depth gauge plus the vernier length.

7.3.2 The scale lines of both the beam and the vernier shall be straight, sharp-edged and perpendicular to the edge of the beam and their thickness shall be between 0.08 and 0.18 mm.

7.3.3 The length of the vernier scale shall be 49 mm (see Fig. 4).

7.3.4 The distance between the graduated face of the beam and the edge of the graduated face of the vernier shall not exceed 0.3 mm (see Fig. 5).

7.3.5 The numbering on the beam and the vernier shall be such that the scale is easy to read.

7.3.6 To facilitate reading, the surface of the beam and the vernier may be given a matt finish and the graduation lines filled with black pigment.

8 ACCURACY

8.1 Error of Measurement

The maximum permissible error of measurement shall be calculated from the following formula:

$$e = \pm (20 \pm 0.05L) \mu\text{m}$$

where

e = the maximum permissible error in measurement in micrometres, and

L = any measured length in millimetres within the measuring range.

The calculated values shall be rounded up to the nearest 10 μm .

NOTE — For convenience the definitive values appropriate to a specific measured length (L) are given below:

Measured Length L	Maximum Permissible Error of Measurement	Maximum Permissible Parallelism Tolerance
mm	μm	μm
0	± 20	8
100	± 30	10
200	± 30	10
300	± 40	20

8.2 Measuring Face

8.2.1 The flatness tolerance of the reference face shall not exceed 0.005 mm and any departure shall be concave in nature.

8.2.2 The parallelism tolerance between the beam measuring face and reference face shall not exceed the value indicated in the formal table in 7.1.

9 DESIGNATION

The vernier depth gauge shall be designated by the depth measuring range, least count, the

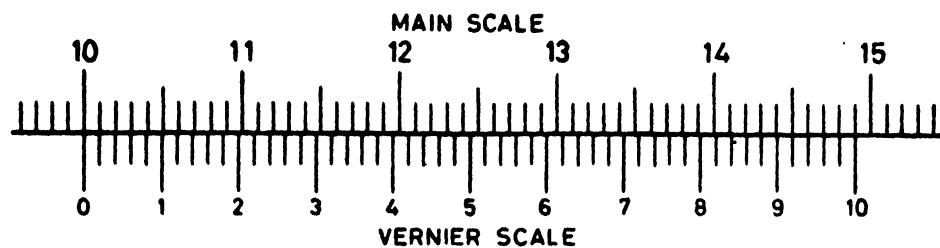
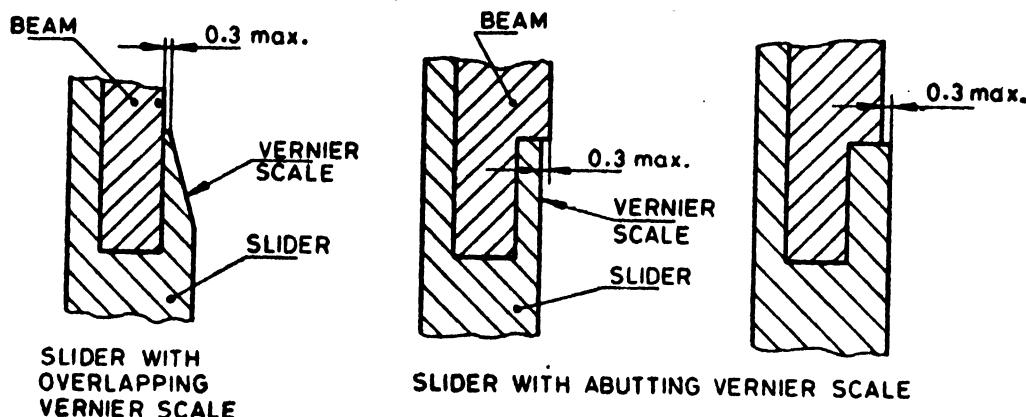


FIG. 4 VERNIER SCALE LENGTH 49 mm



All dimensions in millimetres.

FIG. 5 BEAM AND SLIDER ASSEMBLY

material used, Type and number of this standard.

Example :

- a) A vernier depth gauge with depth measuring range 150, least count 0.02, made from stainless steel and of Type 1 shall be designated as:

Vernier Depth Gauge 150.0.02 Stainless Steel Type 1 IS 4213

- b) A vernier depth gauge with depth measuring range 300, least count 0.02, made from carbon steel and of Type 2 shall be designated as:

Vernier Depth Gauge 300.0.02 Carbon Steel Type 2 IS 4213

10 MARKING

10.1 Each vernier depth gauge shall have legibly and permanently marked upon it, in characters not less than 1 mm high, the depth measuring range of the vernier depth gauge, the least count and indication of the source of manufacture.

10.2 The vernier depth gauge may also be marked with the Standard Mark.

11 PACKING

Each vernier depth gauge shall be coated with suitable anticorrosive coating and shall be wrapped in a moisture proof paper or any other suitable wrapping material. Vernier depth gauge shall be packed in a suitable protective case.

ANNEX A (Clause 1.2) METHODS OF TEST

A-1 ERROR OF MEASUREMENT

The error of measurement shall be checked by setting vernier depth gauge on combinations of slip gauge having precision at least of Class 2 of IS 2984 : 1981. The size of the combination is chosen to cover a number of points both over the range of the instrument and that of the vernier.

Example:

For a gauge with a measuring range of 200

mm; the following slip gauges may be used:
15.10 mm, 100.50 mm and 185.90 mm

A-2 FLATNESS OF MEASURING FACE

This is checked with a knife edge straightedge.

A-3 SCALE LINES

The thickness of scale lines may be checked by direct measurement with a microscope fitted with micrometric device.

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